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ABSTRACT

As growing numbers of children use computers at home and at school, they are at increased risk of developing a repetitive strain injury (RSI). This booklet, designed for parents, explains the primary causes of RSI and gives suggestions for helping children avoid such injury. The booklet is divided into three parts. Part 1 describes various types of RSI, including Carpal Tunnel Syndrome, and discusses the increased incidence in RSI due to the advent of personal computers. Part 2 describes the three primary causes of computer RSI: (1) poorly designed workstation; (2) poor posture and lack of frequent breaks; and (3) poor keyboarding technique. Part 3 presents solutions for each of the primary causes. The booklet contains 16 references and concludes with a troubleshooting chart. (KB)

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Keep[illegible] *Your* Chil[illegible] RSI-free

by Maureen Clancy

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Children and Safe Computing:
Keep Your Child RSI-Free

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Part 1: Computers and RSI

A *computer in every home* - once just a dream of the future - has become a reality. It is quickly becoming a necessity for families with children in school. From doing research online to interactive study to e-mailing friends, your child will barely be able to keep up without one.

This will become increasingly evident the older your child gets as educational demands increase, not to mention rapidly evolving computer technology.

The computer in your home will no doubt help your child learn and succeed.

But the one thing you probably don't know is that the computer is potentially harmful.

Computer use can ***hurt.***

It's true. The fact is that no one really knows the full and long-term effects of computer use. For example, the effect on the human body of the electromagnetic field created by the monitor has yet to be studied.

One effect, though, has become evident during the past 15 years, affecting hundreds of thousands of people: **Repetitive Strain Injury.**

Repetitive Strain Injury (**RSI**) can cause permanent physical damage that will undermine your child's ability to play baseball, hold a pencil, and even affect his or her ability to earn a living.

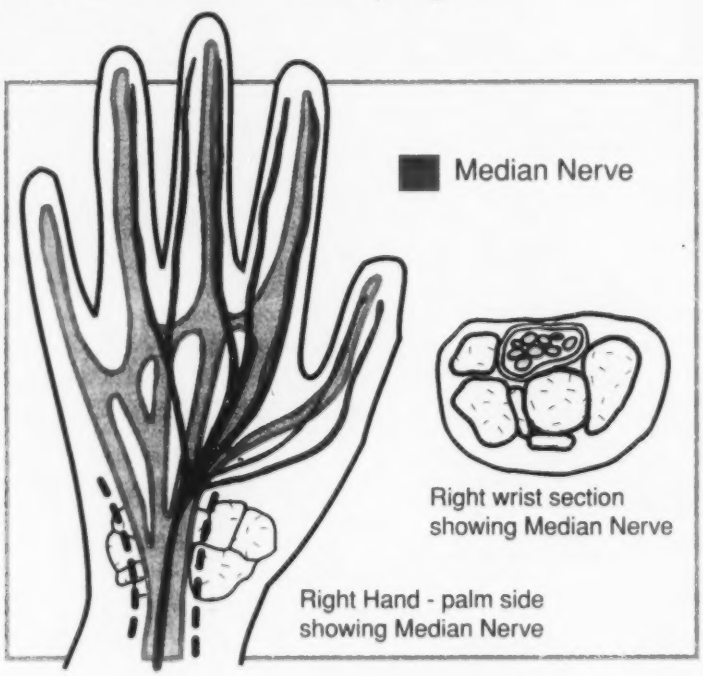
If your child uses a computer at home or at school, then he or she is at risk of developing this serious injury.

What is RSI?

RSI is a musculoskeletal disorder caused by prolonged repetitive and/or awkward movements (such as typing), poor or awkward posture, and poorly designed workstations or work environments. These causes upset the delicate balance of muscles, nerves, and tendons.

RSI from computer use can affect nearly the entire upper body, from the neck to the fingertips.

RSI is actually an umbrella term for a handful of painful disorders. You may have already heard of one type of RSI: Carpal Tunnel Syndrome (CTS), which is the compression of the median nerve — the main nerve that serves the hand. The median nerve along with tendons and blood vessels must pass through the narrow tunnel-like opening at the wrist that consists of eight carpal bones and the carpal ligament. When the tendons become inflamed or swollen from the wear and tear of repetitive movements, they compress the median nerve, resulting in loss of sensation in the hand and fingers.



Though widely recognized, CTS is often misdiagnosed and mistaken for other, lesser known RSIs such as Thoracic Outlet Syndrome and tendinitis.

The pain caused by RSI can be frightening and chronic, from intense and stabbing to dull and aching. Some symptoms include decreased grip strength, pain that disrupts sleep, and general clumsiness of the arms and hands.

Even more debilitating than the pain caused by RSI is the diminished ability to use hands and arms normally. People with RSI can have trouble doing the simplest tasks: gripping a toothbrush, opening a door, and holding a glass.

RSI was virtually unknown before the advent of personal computers, when everyone used typewriters. That's because using a typewriter required a variety of movement, such as inserting and removing paper, returning the carriage at the end of every line, and getting up from the typewriter for information. Now, the computer does all this at the touch of a button while the user remains in the same seated position.

One of the most dangerous aspects of RSI is that it doesn't show up immediately. It can take months or years of unsafe computer use to manifest.

Statistically speaking, RSI is fast becoming the number one work-related injury, accounting for more than 60 percent of all work-related injuries. It strikes workers in virtually all industries and occupations, from journalists and computer programmers to meat-packers and dentists. Between 1980 and 1997, the number of RSI cases tallied by private industry jumped from approximately 23,000 to nearly 300,000. That's an increase of more than 1,000% in just 17 years![1]

It's not just adults who develop RSI. It is children as well. One leading RSI expert based in San Francisco, Dr. Robert Markison, has reported treating approximately two dozen children with RSI — some with severe cases — in the past few years alone.[2]

Recent research shows that computers directly impact children's health.

A 1998 Cornell University study of elementary school children and their school's computer workstations shows that there were "striking misfits" between the children and their workstations. These misfits caused the children to assume awkward postures to use the computer.[3]

A 1996 survey of professors, staff, and graduate students at Carnegie Mellon University found that 22 percent reported symptoms of RSI that they attributed to typing.[4]

While the studies are not definitive and further research is needed, they do point to a serious problem of children's health at the computer.

It is important to note that most schools, where computers are part of your child's daily life, have yet to teach proper computing posture and to properly design computer workstations.

Up to a certain age, children have a natural protection from RSI; they have high levels of growth hormone and excellent regeneration of muscle, and their bodies are flexible and resilient.

Despite this, poor computing habits will put your child at risk, as the following alarming trend illustrates:

College students — who were among the first generations raised on computers — are developing RSI at an increasing rate. They were likely taught or taught themselves how to use a computer, but not how to use one safely. Unaware of the danger, these students developed poor computing habits, and by the

time they got to college with fully grown bodies, the lack of safe computer training put them at serious risk for developing RSI.

These college students should be looking forward to an exciting future and financial independence. Instead they are faced with severe, possibly permanent injury and months if not years of rehabilitation.

This trend is alarming because RSI can be prevented.

As a parent, you can help protect your child from developing RSI. *The best protection is prevention.*

This booklet will explain the primary causes of RSI and how to help your child avoid them.

[1] U.S. Department of Labor, Bureau of Labor Statistics, *Workplace Injury and Illness Summary*, Dec. 17, 1998.

[2] Patricia Hittner, "Technology's Torment," *Better Homes and Gardens*, Dec. 1995, p. 52.

[3,4] Pamela Mendels, "School Computers Might Harm Posture," *The New York Times*, Jan. 17, 1999, p. 16.

Part 2: Three Of The Primary Causes Of Computer RSI

Three of the primary causes of computer RSI are:

- *A poorly designed computer workstation*
- *Poor or awkward computing posture and lack of frequent breaks from the computer*
- *Poor keyboarding technique*

These causes are intertwined; each affects the other. For example, if the workstation is set up properly, then it is easy to have and maintain good posture.

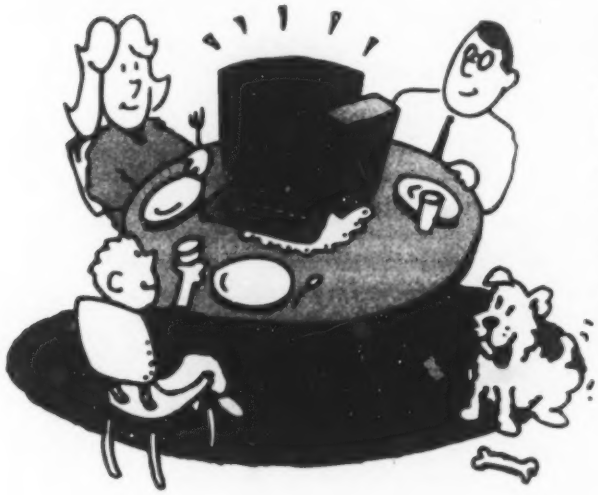
It's bad enough when one of the three causes exists, but when all are present, the risk of injury skyrockets.

POORLY DESIGNED WORKSTATION

You brought the computer home. You probably plunked it down on whatever free space was available, such as the dining room table (which means you have to move it when dinnertime rolls around).

You probably grabbed the nearest chair. And maybe you didn't take the time to think about the placement of the computer, monitor, and keyboard. Perhaps it didn't seem important.

This setup, though convenient, is not user-friendly.



Here's where *ergonomics* comes in. Ergonomics is the science of arranging and/or designing things people use so people can use them most efficiently, comfortably, and safely.

A computer workstation that is not set up ergonomically can be harmful. It can cause your child to sit awkwardly, such as sitting on one bent leg to see the monitor better, squinting from inadequate lighting, or reaching to access the keyboard.

The special problem with setting up a proper computer workstation for children is that most furniture and keyboards are made for adults.

POOR POSTURE/LACK OF BREAKS

The human body is not made to sit at a desk all day. Yet that's just what computers allow your child to do.

What's more, most people don't even know that there is a right way and a wrong way to sit at a computer.

RIGHT : The right way is to sit upright and relaxed. But sitting upright is no small feat. Just think back to when your child learned to sit unassisted. Muscles made it possible. When we move, muscles work.

But working muscles at some point become tired and need to rest. When your child sits upright for a prolonged time at a poorly designed workstation, back and stomach muscles tire, and delicate eye muscles tire from looking at a monitor without adequate rest breaks. When muscles are tired, your child tends to slouch.

WRONG : Slouching is the wrong way to sit at a computer. It causes the shoulders to move down and roll forward, which makes the chin jut out. This position places strain on the neck and back, which in turn strains the entire upper body.

Because the computer is so much fun to "play with," your child can be lulled into using it for hours without a break. This means that tired muscles are not properly rested, which increases the risk of injury.

POOR KEYBOARDING TECHNIQUE

Keyboards are designed for adult hands, not child hands. Children have to overcompensate by stretching and straining their fingers to reach the keys.

Typing is a strenuous task. To hold the arms up and hands out over the keyboard to type, your child has to defy gravity. Proper arm support is crucial. Most household chairs however don't have arm rests or have ones that are too far apart for children to use.

Because the small muscles of the arm fatigue quickly children end up resting their wrists on the desk or wrist pad while typing. This causes dorsiflexion — hands that are bent up at the wrist. **Dorsiflexion,** also known as wrist extension, causes compression of the median nerve (the main nerve of the hand), which can lead to CTS and other RSIs.

Resting the wrist on the desk or wrist pad while typing shifts the work load from where it should be (in the big joints and muscles of the shoulder) to where it shouldn't be (in the small tendons of the fingers).

Additionally children sometimes use excessive force to press keys, which can cause tingling and nerve damage in their fingers.

Lastly comes the mouse. Thanks to the point and click format of most computer software, it is nearly impossible to navigate around a computer without a mouse. Children tend to grip the mouse too tightly and hold their arms too far from their torsos.

Part 3: The Solutions

PROPERLY DESIGNED WORKSTATION

Desk, chair, monitor, computer, keyboard, mouse, and lighting

To ensure that your child's workstation is properly designed, adjust the workstation to fit your child, not the other way around. Ergonomics means arranging and/or designing things people use so people can use them most efficiently, comfortably, and safely.

The Desk

Dedicate a surface in the house solely for the computer, so the proper setup has to be done only once, not every time the computer is used. If the computer is on the dining or kitchen table, move it to a better location.

The surface or desk should have space both for the computer and for writing, so your child won't have to sit awkwardly to write while using the computer. Two such desks to consider are an L-shaped desk or a desk with a corner piece.

Most desks are 29 inches or 26 inches high. The 26-inch height works best for most children.

The Chair

Buy an adjustable chair if there is only one piece of computer furniture you can afford. Ideally, it should have the following features:

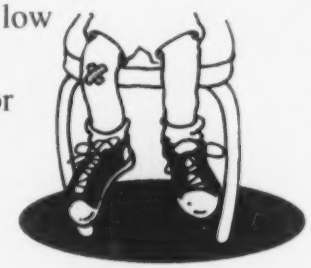
- Wheels or casters, to make getting in and out of the workstation easier, which will encourage frequent breaks.
- A swivel seat.
- Height adjustability, to allow for a growing child (also important if more than one family member uses the computer).
- Arm rests, to reduce shoulder and arm fatigue.

If you can't buy an adjustable chair, use a straight-back chair that's not being used for something else.

Now that you have the chair, make it child-sized:

1. Put a pillow against the back of the chair to shorten the seat depth.

2. Put a pillow on the seat if the chair is too low (which you'll know if your child lifts his or her chin to look up at the monitor or if his or her arms are stretched out and lifted up to use the keyboard).



3. Check for dangling feet, which is common with children. Foot support reduces back strain and encourages proper posture. Make a footrest using overturned empty boxes, phone books taped together, or pillows. Your child's feet should rest comfortably with his or her knees bent at a 90-degree angle and not higher than the hips.

The Monitor

Place the monitor directly on the desk or work surface. Avoid putting it on top of the computer; this can make the monitor too high for your child to see comfortably and safely.

The ideal monitor distance is approximately one arm's length from eyes to monitor.

The ideal monitor height is reached when the top of the screen is at eye level or slightly below.

The Computer

Place the computer either next to the monitor or on the floor next to the footrest or feet. Both positions allow access to diskette and CD-ROM drives.

The Keyboard and Mouse

Your child is connected to the computer through the keyboard and mouse. It is crucial that these input devices are positioned correctly.

Place the keyboard and mouse directly on the desk or work surface close to the edge of the desk (be sure there's arm support). This helps eliminate the tendency to rest arms and wrists on the desk or wrist pad while typing. When not typing, resting arms and wrists helps reduce fatigue.

For maximum comfort, try one of the following add-ons:

- An articulating keyboard drawer. This drawer mounts to the underside of the desk and is pulled out when needed. It is highly adjustable: you can raise or lower it, tilt it toward or away from you, and swivel it 180-degrees to a comfortable position. Choose a drawer designed to hold both the keyboard and mouse.

- A standard keyboard tray. This tray also mounts to the underside of the desk. The keyboard and mouse are placed on the tray, which is pulled out when needed. Trays allow for a lower keyboard height to accommodate children, and gets the

keyboard out of the way so more of the desk surface can be used for other tasks. Choose a keyboard tray that is wide enough for both the keyboard and mouse.

- A mouse bridge, which is an elevated mouse pad that fits over the numeric keypad to bring the mouse even closer to the keyboard. It's ideal for those who don't use the keypad.

The ideal keyboard height is reached when elbows are at a 90-degree angle with arms.

The ideal mouse position is as close to the keyboard as possible.

Lighting

Use soft lighting. The monitor itself is a light source, but should not be the only source. Use a task light for reading and writing. Be sure that lights do not cause glare on the computer screen or shine in your child's eyes.

PROPER POSTURE AND FREQUENT BREAKS

Proper Posture

With an ergonomically-designed workstation, good posture is easy to maintain.

NOTE: Sitting up straight should always be relaxed, not rigid.

Proper posture should be comfortable because it uses the right muscles for the right job. Shifting and occasionally adjusting posture is fine as long as the principles of proper posture are maintained.

Notice the following in the illustration of good computing posture:

~ Head rests comfortably and loose, in a neutral position
~ Chin tucked in
~ Back straight
~ Shoulders relaxed (not shrugged) and slightly backward
~ Elbows at a right angle to arms
~ Wrists relaxed and in a neutral position, in line with the forearms
~ Fingers slightly curved, floating above the keyboard
~ Thighs at a right angle to torso, knees at a right angle to legs
~ Feet firmly on floor or on foot rest

To help your child understand proper computing posture, try the following posture activity.

Posture Activity

1. Have your child sit at the computer workstation after you've set it up ergonomically.
2. Show him or her the illustration of proper posture.
3. Ask your child to imitate the illustration.
4. Ask if he or she is comfortable. Good posture should feel comfortable, not stiff.
5. If your child is squirming and has difficulty, have him or her try to at least sit upright with his or her chin tucked in and wrists in a neutral position.

Please refer to the posture troubleshooting chart on page 24 for further guidance.

Frequent Breaks

One thing that will help ensure proper computing posture is taking frequent breaks from the computer. Fatigued muscles and eyes need to rest. Just 5-10 minutes every half hour is enough.

Do not underestimate the importance of taking frequent breaks. It is absolutely essential.

One way to get your child to take a break is to set a kitchen timer, an alarm clock, or any outside sound that you can program to ring every half hour. You can also set an alarm within the operating system of both IBM-compatible computers and Macintosh computers. Consult the user's manual for complete instructions. You can buy computer break software that puts a break-reminder window on the monitor and freezes the keyboard at set intervals.

Another way to get your child to take a break is to make it vacation time. Tell your child that he or she can use the computer for a half hour and then take a vacation from it when the bell rings.

On his or her vacation, have your child get up and do any or all of the following:

- Walk to the nearest window and focus on the furthest object they can see for a few minutes. Repeat 2 or 3 times, finding a different object each time.
- Go to the kitchen and drink a glass of juice or water.
- Stretch, as described below.

Stretching Activity

Stretching is an ideal vacation activity that not only relaxes tired muscles, but also brings them necessary blood and oxygen.

Just as there is a right and wrong way to sit at the computer, there's a right way and a wrong way to stretch.

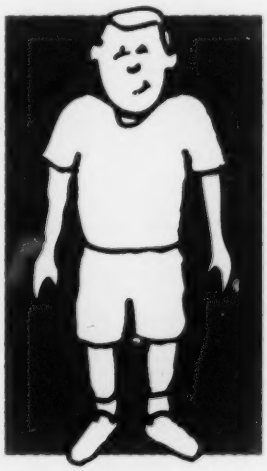
RIGHT : Slowly and smoothly until a gentle stretch is felt.

WRONG : Bouncing, while in pain, or to the point of pain.

WARNING: As with any health-related activity, consult your child's doctor before beginning any exercise program.

1 - Reach for the Sun Stretch

Stand with feet hip-width apart and arms at sides. Lift arms over head and reach up with the right hand and then the left hand until a gentle stretch is felt in each arm and down the sides of the body. Breathe steadily and be sure to keep the shoulders relaxed. Then fan arms out and down to sides. Repeat 3 times.



2 - Shrug Stretch

Stand with feet together and arms at sides. Inhale and shrug shoulders up toward ears and hold for a count of 5, then exhale and let them drop down. Repeat 3 times.

3 - Talk to the Hand Stretch

Stand near a wall with feet together. Extend right arm out to wall and straighten elbow with palm against wall until a gentle stretch is felt on the underside of the forearm. Hold for a count of 10. Breathe steadily and be sure to keep the shoulders relaxed. Repeat 3 times for each arm. Do the same with the back of the hand against wall until a gentle stretch is felt on the top of the forearm.

4 - Listen to Your Shoulder Stretch

Stand or sit with feet together and arms at sides (if standing) or on lap (if sitting). Gently bring the right ear to the right shoulder (keeping the shoulder relaxed) until a gentle stretch is felt on the left side of the neck. Hold for a count of 10, breathing steadily. Repeat 3 times. Do the same with the left ear until a gentle stretch is felt on the right side of the neck and shoulder.

PROPER KEYBOARDING TECHNIQUES

Using an adult-sized keyboard can be tricky for children. Most importantly, children need to move their entire arms to reach the keys rather than stretch or twist. They also need to keep their wrists in a neutral position (not bent up or down). Try the following activity.

Go to the Keys Activity

1. Have your child sit at the computer and open the word processing software.
2. Ask your child to move his or her entire right arm like a pivot from the elbow to press the Enter key.
3. Repeat with other keys such as the Shift key, the Control key, and the Tab key.

This same principle — going to the keys instead of reaching for them — should be applied to all keys.

Another crucial point to discuss with your child is the use of proper force to depress the keys. Research shows that most people use more force than necessary to press the keys on a keyboard, resulting in pounding or clacking. The alarming part is

that people do this without even realizing it. To help your child become sensitive to this, try the following activity.

Light Touch Activity

1. Have your child open the word processing software and type the following two sentences, while you observe the amount of force used:
   a) I do not need to pound the keys.
   b) I will use the lightest touch possible when pressing the keys.
2. Ask your child to type the same sentences again, only this time using the lightest touch possible to get the letters to appear on the screen.
3. Ask if your child noticed the difference in force. If not, repeat the activity.

NOTE: The light touch requires a relaxed body. A tense body may increase the risk of injury.

Mousing

It is important to hold the mouse gently rather than tightly. Your child should avoid resting his or her wrist on the desk while mousing, which may cause dorsiflexion (refer to definition on page 10). The elbow should be at a 90-degree angle with the arms, and the mouse should be as close to the keyboard as possible with your child's elbow close to his or her torso.

REMEMBER ...

The computer is a tool, and like other tools, it should be used with utmost safety. Though your child might consider it a toy, the computer can be just as dangerous as a blender or drill if used carelessly.

Being aware of the danger and implementing the changes suggested in this booklet will help ensure your child's safety at the computer now and in his or her bright future.

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Maureen Clancy is available to speak to groups, organizations, and businesses about the information contained in this booklet. She is also available for computer safety and workstation consulting to individuals and businesses. Please write or call:

Upright Press and Consulting
PO Box 1786
Southold, New York 11971
1-800-537-1560

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TROUBLESHOOTING CHART

PROBLEM	CAUSE	SOLUTION
Your child's chin juts out and forward	Monitor may be too high	Place the monitor directly on the desk
	Chair may be too low	Raise the chair height (if using an adjustable chair) or add pillows to the seat
Your child is leaning forward or squinting	Monitor may be too far away	Move it closer
	Font size is too small	Increase the size
Your child's arms are lifted high and held out over the keyboard, with elbows at less than a 90-degree angle	Keyboard may be too far away	Move it closer to the edge of the desk
	Chair may be too low	Adjust the chair height (if using an adjustable chair) or add pillows to the seat
Your child's arm is held out from his or her torso to use the mouse	Mouse is too far away	Move it closer to the keyboard
Your child's feet are dangling	If chair height and other workstation components and posture are correct, then your child needs a footrest	Add foot rest using an overturned box, phone books or pillows

Computer use can be dangerous!

- *Physical injury from continuous computer use, called Repetitive Strain Injury (RSI) and sometimes Carpal Tunnel Syndrome, has affected hundreds of thousands of people, and the numbers keep rising.*

- *RSI can cause permanent physical damage that will affect your child's ability to play baseball, hold a pencil, and even undermine his or her ability to earn a living.*

- *Because the computer is so much fun to play with, your child can be lulled into using it for hours without a break, setting the stage for serious injury.*

Protect your child from computer-related RSI. This booklet will teach you how.

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